

Place Matters in the Helping Professions: GIS for Human and Social Services Organizations



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Place Matters in the Helping Professions: GIS for Human and Social Services Organizations

An Esri White Paper

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Place Matters in the Helping Professions: GIS for Human and Social Services Organizations

Introduction and Purpose of Paper

Around the world, over half a million social workers¹ and human service professionals are helping vulnerable and distressed people every day. Their clients include foster children, the elderly, the mentally ill, the homeless, the disabled, and many others in need. Social workers and human service professionals accomplish their work through hundreds of different programs in government agencies, nonprofit organizations, private practices, and other groups. These programs are in great demand due to the global economic crisis and numerous other drivers including changing demographics. Increased demand for human and social services brings new attention to concerns regarding access to services, efficiency, and program integrity.

Academics have made the case that social work needs mapping.^{2,3} This white paper describes how geographic information systems (GIS) fill that prescription. GIS is a key component in modernizing the information technology (IT) of many human and social service programs. By leveraging the data management, analysis, and visualization capabilities of GIS, social workers and other human service professionals (hereinafter referred to collectively as *helping professionals*) are empowered to understand community needs, measure environmental forces (including access to services), deliver services more efficiently, and detect fraud and abuse. After reading this white paper

- Senior management of human and social service organizations will understand the importance of geographically enabling information systems (with GIS) to support their core missions.
- Helping professionals will recognize how GIS can support their business processes and workflows.
- IT personnel will understand that Esri® technology is scalable from the desktop to the server to mobile devices and is available in the cloud.

While this paper includes extensive references specific to the United States, it is intended as a reference for all nations' helping professionals, agencies, and programs.

¹ The International Federation of Social Workers is a federation whose national associations in 84 countries have close to half a million members (see www.ifsw.org/p38000908.html).

² Hillier, Amy. "Why Social Work Needs Mapping." *Journal of Social Work Education* 43, no. 2 (2007): 205–221. Retrieved April 2, 2009, from repository.upenn.edu/spp_papers/86.

³ Queralt, Magaly, and Ann Witte. "A Map for You? Geographic Information Systems in the Social Services." *Social Work* 43 (September 1998): 5.

Importance of Place in the Helping Professions

There is a strong historical and theoretical underpinning for the notion that *place matters* in human and social services.⁴ As far back as the late nineteenth century, settlement house workers at Hull House (Chicago, Illinois, United States) developed a series of community maps as a means of assessing social and economic injustices in Chicago neighborhoods.⁵ A historic and defining feature of social work has been the profession's focus on individual well-being in a social context and the well-being of society. Fundamental to social work is attention to the environmental forces that create, contribute to, and address problems in living.⁶ But how do helping professionals analyze a person within the context of environment? How are they supposed to measure environmental forces?

In the mid-1990s, a National Science Foundation initiative emphasized the importance of using GIS technology for human services research purposes.⁷ In the late 1990s, Queralt and Witte concluded that there were outstanding potential rewards for social service agencies using GIS in terms of agency planning, data analysis, policy making, fundraising, client information, outreach, and other functions.⁸ Recently, Hillier has eloquently advocated the need for mapping in social work. She suggests that GIS can benefit such work by

- Continuing and strengthening the social survey tradition
- Providing a framework for understanding human behavior
- Identifying community needs and assets
- Improving the delivery of social services
- Empowering communities and traditionally disenfranchised groups⁹

In summary, there are an increasing number of justifications¹⁰ for helping professionals to leverage GIS for better program planning, research and evaluation, and communication with the public.

Structure of Paper

This paper is composed of five parts. The first is this introduction, which describes the purpose and structure of the paper. The second section describes human and social services organizations, including some of their typical programs and services, common business processes, and information systems. The third section describes geographically enabling human and social services and includes an explanation of enterprise GIS within health and human services (HHS) agencies. The fourth section discusses the future of GIS and human and social services. The final section offers suggestions for how to get started, including specific resources available from Esri and its partners for human and social services organizations, systems integrators, and other software developers.

⁴ See Steinberg, Steven J., and Sheila L. Steinberg. *GIS: Geographic Information Systems for the Social Sciences; Investigating Space and Place*. Sage Publications, 2006.

⁵ Tompkins, Paige L., and Linda H. Southward. "Geographic Information Systems (GIS): Implications for Promoting Social and Economic Justice." *Computers in Human Services* 15 (1998): 209–228.

⁶ National Association of Social Workers (NASW). Code of Ethics of the National Association of Social Workers. Retrieved May 13, 2009, from www.socialworkers.org/pubs/code/code.asp.

⁷ Mandayam, Gokul. Geographic Information Systems: A Planning Tool for Human Service Agencies. Retrieved May 12, 2009, from www.gisdevelopment.net/application/health/overview/health0007pf.htm.

⁸ Queralt and Witte, "A Map for You."

⁹ Hillier, "Why Social Work Needs Mapping," 206–215.

¹⁰ Wong, Yin-Ling I., and Amy Hillier. "Evaluating a Community-Based Homelessness Prevention Program: A Geographic Information System Approach." *Administration in Social Work* 25 (2001): 21–45.

Human and Social Services Organizations

Typical Programs in Human and Social Services

All helping professionals work somewhere. They can be employed by government agencies (national, provincial, local), nonprofit organizations (sometimes referred to as nongovernmental organizations, or NGOs), private and public facilities, and private practices. Some work is done at the office; other work is done in the field. Below are some of the most common programs and services offered by human and social services organizations:

- Adoption services
- Adult protective services
- Behavioral health
- Child abuse, neglect, and welfare (e.g., Child Protective Services)
- Child care licensing
- Child care support
- Child support enforcement
- Disabilities (e.g., developmental, intellectual)
- Domestic violence (e.g., hotlines, counseling, shelters)
- Early childhood interventions (e.g., Head Start)
- Elderly services (e.g., adult day care, Meals on Wheels)
- Ex-offender services (e.g., housing, employment, substance abuse assistance)
- Family services (e.g., family therapy)
- Foster care
- Healthy aging programs
- HIV/AIDS (e.g., housing services, nutrition services)
- Home and community-based services (HCBS)
- Homeless services and housing assistance
- Hospice services
- Immigrant services
- Independent living programs
- Infant day care
- Long-term care services
- Marital counseling/Healthy marriage programs
- Mental health services
- Nutrition assistance (e.g., food stamps)
- Nutrition assistance (e.g., infants, mothers, elderly, medically needy)
- Nutrition education (e.g., infants, mothers)
- Ombudsman
- Parenting services (e.g., parenting education, single-parent support)
- Protective services
- Public housing
- Refugee services
- Rehabilitation services
- Services for the blind
- Services for the deaf

- Substance abuse services (e.g., detoxification, individual and group therapy, methadone)
- Temporary assistance for the poor (e.g., Temporary Assistance for Needy Families [TANF] in the United States)
- Vocational rehabilitation
- Youth services (e.g., at-risk youth)

Business Processes in the Helping Professions

The typical programs listed above have different clients, priorities, and goals. However, many have similar core activities or business processes. Examples include needs assessment, program planning, case management, information and referral, routing and logistics, research and evaluation, and communication and reporting. Some business processes have their own well-developed IT systems; others are done on an ad hoc basis. While some business processes are more relevant to specific levels of government (national, provincial, local) or to organizations working at the community level, all organizations have a role in these processes. Below are brief descriptions of these business processes, related IT systems, and the importance of GIS.

Needs Assessment and Intake Eligibility

Funders require applicant organizations to determine intake eligibility and conduct assessments of the need for services, propose intervention strategies that are realistic and achievable, and monitor progress and results. Many organizations also conduct their own internal strategic planning processes on an annual basis to assess the effectiveness of organizational structures (e.g., centralized or decentralized) and analyze strengths, weaknesses, opportunities, and threats. Increasingly, the accessibility of quality social services and facilities for families and children is a key public policy concern.¹¹ Hillier argues, "Documenting need is not enough; documenting *where* there is need is critical to intervention strategies."¹² Jurisdiction-wide workforce assessments may also determine specific shortage areas (e.g., behavioral health service professional shortage areas).

GIS helps illustrate unmet needs and overlapping or redundant services.¹³ Examples of GIS functions include thematic mapping (e.g., census data regarding children under age five living in poverty), geocoding locations of existing service centers so they may be mapped and analyzed, and proximity analysis (e.g., distance buffering and constructing service areas). As Pamuk states, multilayer analysis through GIS is more powerful because it incorporates additional variables into decision making and can work with either vector or raster data. Using GIS, organizations can answer questions such as

- What is the relationship between locations of service providers and client density?
- What is our organization's service area?
- What is the availability of services within informal settlements in major urban centers?¹⁴

¹¹ Pamuk, Ayse. *Mapping Global Cities: GIS Methods in Urban Analysis*. Redlands, CA: Esri Press, 2006.

¹² Hillier, "Why Social Work Needs Mapping," 212.

¹³ Pamuk, *Mapping Global Cities*, chapter 4.

¹⁴ Thielen, Aaron M. 2008. Using GIS to Examine the Head Start Service Area in Winona County, Minnesota. *Papers in Resource Analysis*, Volume 10. Winona, MN: Saint Mary's University of Minnesota Central Services Press. Retrieved March 2, 2011, from www.gis.smumn.edu/GradProjects/ThielenA.pdf. 12.

By answering such questions through GIS analysis, organizations address a major goal of programs: to have a proper match of services and resources to need. The ability of an agency or NGO to provide accessible services requires an understanding of the spatial distribution of the population it intends to serve as well as knowledge of the location and reach of existing services. Location is by no means the only factor in accessibility, but it is a major factor both in terms of physical accessibility of clients to a service site and distance for field staff to travel to clients.

Program Planning

For each program, personnel must decide on program priorities, set goals, and create and monitor work plans. Program planning also includes the capability to conduct site analysis (e.g., Where should we locate our next facility or event?) and prioritize staff assignments (e.g., Where are staff located, and is this optimal?).

As with needs assessment, GIS adds value to many of these program planning business processes. Some organizations have developed (or hired consultants/firms to develop) web-based data query systems with GIS functionality to assist with program planning. These data warehouses with an interactive interface query can support routine and ad hoc analyses (both internally and by the public). For example, the Alabama Resource Management System (ARMS)¹⁵ is a human services data query system specifically designed with local-level organizations in mind. Organizations may also leverage desktop GIS for ad hoc analyses.¹⁶

Case Management

One of the primary business functions of helping professionals is to provide case management for their clients, whether in an agency office, at clients' homes, or in other service delivery settings. Professional social work case managers are guided by standards¹⁷ and routinely use computerized case management information systems. Such systems help conduct assessments of clients, determine eligibility for services, implement service plans, track client contacts and history, track progress toward meeting goals, report results, and assist with billing, among other functions. Case managers perform a range of common tasks related to client- and system-level intervention. They are keenly interested in intervening at the points where clients interact with their environments. It is critical for such decisions to be evidence informed, and professionals must develop systems that promote consistency in decisions. For case management, there are many IT solutions. Vendors have developed case management systems for diverse program areas: aging services, automated child welfare, behavioral health, homeless information management, mental health, nutrition assistance (Women, Infants, and Children [WIC]), and substance abuse, among others.

GIS adds value to case management systems by providing case managers with the tools for understanding clients and their environments. It is possible to visualize and analyze where they live, how they get to work, where they go to school, and what the "triggers" are in their neighborhood. This data is represented by points, lines, and polygons that inform GIS-based proximity analysis (to find available services for the client) or multilayer analysis. For example, the SchoolMinder application from the Illinois

¹⁵ Marshall, Patrick. "Alabama at Your Fingertips." *Government Computer News*, April 20, 2009, gcn.com/articles/2009/04/20/arms-provides-data-maps-to-agencies.aspx.

¹⁶ Mandayam, Geographic Information Systems.

¹⁷ NASW Case Management Standards Workgroup. 1992. NASW Standards for Social Work Case Management. Retrieved April 2, 2009, from www.socialworkers.org/practice/standards/sw_case_mgmt.asp#intro.

Department of Children and Family Services¹⁸ has helped case managers integrate geography into foster care placement decisions, thereby greatly decreasing the average distances between a child's current school and his or her new foster home. Other case management systems have additional GIS-powered workflows, including fraud detection capabilities.¹⁹

Social workers are not the only helping professionals who benefit from using GIS for understanding the context and environment of their clients; medical professionals such as physicians may also benefit. In a recent editorial in the *Journal of the American Board of Family Medicine* entitled "Mapping Primary Care, Putting Our Patients in Context," Dr. Norm Oliver suggested that "Knowing a patient's context can make the difference between just treating a child's injury and also calling protective services."²⁰

Information and Referral

Helping professionals have always been in the information and referral business. Historically, they have been the repositories of local information regarding the availability of social services. The Internet has facilitated the evolution of many information and referral initiatives from annual printed directories to web-based systems. Recently, community information and referral have received extensive national policy attention in the United States²¹ and throughout the European Union.²² Governments have recognized that with the high mobility of their citizens, it becomes important that access to social services does not depend on local knowledge. A popular trend is the assignment of a particular phone number for social services information and referral (e.g., 211 in the United States) or series of phone numbers with the same prefix for specific social service hotlines (e.g., 116-xxx in the European Union). Information and referral begin with knowing the location of the client, understanding the client's needs, matching the client with appropriate services (based on availability and location), and providing detailed options and instructions on how to access the services.

U.S. HHS agencies such as ACF, AoA, and SAMHSA are taking a lead with the development of national services locators for their respective program areas. Nonprofit organizations such as the United Way are advocating universal information and referral (I&R) coverage (e.g., 211) at state and local levels. Individual hotlines (e.g., domestic violence) are integrating GIS functionality into caller identification (reverse geocoding) so that they may quickly come up with options for the closest referral. GIS-enabled resource locators can be more efficient and effective²³ than relying on internal resource directories (e.g., printed directories or Access and SQL databases). When web based, such systems can provide information not only to helping professionals but also to the broader public (some of whom are then able to help themselves). Some GIS-enabled

¹⁸ Esri. "There's No Place Like Close to Home: Illinois Takes a Geographic Approach to Foster Care." *HealthyGIS* (Fall 2007): 8–9. Retrieved March 2, 2011, from esri.com/library/newsletters/healthygis/healthygis-fall2007.pdf#page=8.

¹⁹ eWEEK. "Louisiana Stamps out Food-Stamp Fraud," 6/8/2006. Retrieved March 2, 2011, from www.eweek.com/c/a/Database/Louisiana-Stamps-out-FoodStamp-Fraud/.

²⁰ Oliver, Norm. Editorial in *The Journal of the American Board of Family Medicine* 23, no. 1 (2010): 1–3. Retrieved January 14, 2011, from jabfm.org/cgi/content/full/23/1/1.

²¹ United Way/Alliance for Information and Referral Systems. PASS 2-1-1. Retrieved May 26, 2009, from www.211us.org/legislation.htm.

²² European Commission. Pan-European Numbers and Services. Retrieved May 26, 2009, from ec.europa.eu/information_society/policy/ecomm/current/pan_european/index_en.htm.

²³ Esri. "Domestic Violence Hotline Calls for Support: GIS Serves Call Center." *ArcNews* (Summer 2005): 2. Retrieved March 2, 2011, from esri.com/news/arcnews/summer05articles/domestic-violence.html.

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information and referral systems include public transportation options in their queries and discharge directions/maps (as discussed below).

Routing and Logistics

Helping professionals working directly with clients (e.g., in case management) may need to help them determine how they will get to additional needed services. Helping professionals working in the field also need to navigate to new locations safely for home visits (e.g., HCBS), community meetings, and other events. Organizations may need to forecast and track transportation expenses. Some organizations manage their own transportation systems (shuttles, paratransit, etc.) that enable clients to access services more easily. In some cases, organizations must schedule large numbers of helping professionals to work on specific cases based on location.

All these routing and logistics examples benefit from GIS, whether the analysis is for locating closest services, simple routing directions, drive-time analysis, an optimum route based on multiple stops, or service area definition. After implementing GIS-based IT solutions, organizations have made the same number of deliveries with fewer drivers, seen drops in mileage and fuel consumption, and improved arrival time estimates.²⁴ GPS-enabled vehicle tracking systems are also increasing in popularity for both efficiency and security reasons, and some organizations are using GPS phones with GIS to enhance information and process flow between field-workers, supervisors, and state offices.²⁵

Policy Development/ Advocacy/ Community Organizing

Besides working with individual clients, helping professionals work at the systems level to develop policies and advocate for the needs of specific populations (as dictated by their ethical standards). Policy decisions often require data that is aggregated over time and space. Helping professionals often attend (or organize) community meetings.

GIS has unique capabilities for analyzing data and modeling the impact of policy decisions. For advocacy purposes, maps informed by quality data are descriptive and compelling. Maps are also very helpful as a discussion aid for community meetings. Organizations have leveraged the web-based data query systems referenced above for all these purposes; many organizations also use desktop or server-based GIS applications for these tasks.

Research and Evaluation

Leaders of human and social services organizations want to ensure that all services are informed by best practices and focused on relevant outcomes for their populations of interest. Organizations have also moved toward performance contracting and have sought ways to more efficiently detect and investigate fraud. There are many spatial components to such research and evaluation initiatives. Examples include ensuring that services are available within a specific distance and detecting abnormalities in program beneficiary location (to prioritize limited investigation resources).

For research and program evaluation, many organizations use business intelligence (BI) software and/or stand-alone statistical analysis software compatible with GIS software.²⁶

²⁴ Esri. "Metropolitan Area Neighborhood Nutrition Alliance: Esri's Logistics Solution Helps Streamline Meal Delivery Service." *HealthyGIS* (Summer 2010): 6. Retrieved March 2, 2011, from esri.com/library/newsletters/healthygis/healthygis-summer2010.pdf#page=6.

²⁵ Mississippi Department of Human Services. AGPS/LBS Mobile Phones and GIS. Presentation at www.aphsa-ism.org/home/doc/2008Conf/AGPS_LBS.ppt.

²⁶ SAS Bridge at www.sas.com/products/bridgeforesri/. (Esri's software also has significant spatial statistics tools; see webhelp.esri.com/arcgisdesktop/9.3/index.cfm?TopicName=An_overview_of_the_Spatial_Statistics_toolbox.)

As mentioned above, some case management systems now have GIS-powered workflows, including fraud detection capabilities.

Communication and Reporting

Internal leadership, policy makers at all levels of government, and the public all want to stay informed about human and social services issues, available programs and services, and progress in meeting goals. Static maps are helpful in reports (printed and electronic), press releases, and other media such as websites. Increasingly, the public is growing accustomed to interactive mapping. Programs also have to deal with constantly evolving reporting requirements for block grants and other specific funding streams. Some of these reporting requirements have spatial components including documenting improved access to services.

Increasing GIS synergies with common document formats such as PDF reports (e.g., enabling publishing of GIS layers) has opened up many new possibilities for communication and reporting. Business intelligence and reporting software is also increasingly integrated with GIS.

Geographically Enabling Human and Social Services Information Systems

Understanding Geography as a Common Frame of Reference

Modernizing human and social services information systems to facilitate more efficient business processes requires geographically referenced information. The science of geography recognizes that almost everything that exists can be expressed in terms of its location, and therefore, geographers have established a standard framework of spatial coordinates to communicate and relate the placement of people, things, and events, wherever that may be. Therefore, geography provides a spatial baseline that is used for storing, analyzing, and communicating most types of data. Eventually, geography supplies structurally coherent common ground for decision support mechanisms.

Justifications for Incorporating GIS into Business Processes and IT Systems

One might agree with the notion that place matters in human and social services, but how does it translate into the everyday work of helping professionals working in child protection, information and referral, substance abuse, elderly services, and so on? Geographically enabled IT systems coupled with appropriate GIS technology provide helping professionals with enhanced capabilities that may be leveraged throughout many business processes. Helping professionals stand to benefit profoundly from the increased application of geographic intelligence through GIS technology:

- GIS improves organizational performance through significant administrative and program savings:
 - Improved quality of geographic data to provide policy and practice decision support
 - Reduced undeliverable mail
 - Saved time and money spent correcting wrong addresses
 - Saved time and money on more efficient routing of vehicles

- Point-of-registration address management and geocoding to vastly improve geographic accuracy and decision making
- Timely identification of provider and client fraud (e.g., food stamps)
- GIS improves service delivery:
 - Increased referral compliance for clients through discharge maps and directions
 - Determining provider access for more efficient service delivery planning
 - Improved call center efficiency utilizing reverse geocoding to identify caller locations
 - More efficient routing of vehicles
 - Early identification of significant community problems
- GIS facilitates data integration:
 - Integration of a variety of third-party and externally collected data from within the government as it might be related to fraud and abuse, site location, expected service volumes, utilization management, and surveillance and tracking requirements
- GIS helps perform essential specific analyses:
 - Eligibility determination
 - Referral (closest, options within a distance range or area, options on a route)
 - Access to services (including performance measures, network analysis, and service area definition)
 - Trend analysis and detection
 - Utilization of services by geography
 - Fraud and abuse detection

Besides the justifications listed above, GIS helps organizations have more client-centric IT systems facilitated by common standards, interoperability with other organizations, and web-based access and integration.

For a system to be **client-centric**, it is absolutely necessary to know where the client lives and his or her relative level of access to providers of services, as well as positive and negative environmental forces. GIS facilitates such analyses and enhances client-centric case management (e.g., tools for analyzing access to transportation) and the

consumer/user experience (e.g., providing a public-facing services locator and/or human services data query system).

Increasingly, funders are advocating **common standards** through which human and social services information systems can interoperate with other systems, such as the Medicaid Management Information System (MMIS). Esri is a member of Health Level 7 (HL7) and recently published a working paper regarding HL7 and locational accuracy that covers this topic in detail.²⁷ Esri's current products have appropriate open application programming interfaces and support key data interchange formats and web services standards for ensuring relevant GIS and IT interoperability between systems over wired and/or wireless networks. Another example of a common data standard critical in day-to-day operations would be an address management and geocoding system.

Human and social services organizations desire **interoperability between organizations**, both within and across jurisdictions, as well as with other agencies such as public health and health care. Esri is the standard GIS for most human service and public health agencies and a growing number of health care organizations. GIS provides many data management and analysis tools for integrating human and social services data with other public health data. A more detailed description of Esri interoperability is included in the section Esri Interoperability and SOA.

Finally, many of the IT systems in human services and social services now require **web-based access and integration**. ArcGIS® Server facilitates this.

Existing GIS in Health and Human Services Agencies

Health and human services agencies around the world have embraced GIS as a tool for collecting and analyzing data, evaluating health programs, and communicating results (internally, to policy makers, and to the public). These departments use GIS on a daily basis to analyze the spread of infectious disease, promote and encourage healthy behaviors (e.g., targeted communication), protect the public against environmental hazards (e.g., cancer registries, enforcing regulations, plume modeling, targeted notification), prevent injuries (e.g., analyzing traffic injuries by location), respond to disasters and assist communities in recovery (e.g., situational awareness, identifying vulnerable populations), and ensure the quality and accessibility of health services as well as many other programs and services.

Enterprise GIS, Geocoding, and Shared Business Capabilities

Over the same time frame as the rise of various human and social services programs, GIS technology has emerged as a powerful tool in many sectors. Recognizing the growing importance of GIS, state CIOs in the United States put GIS on their top ten list of priority technologies for 2008. GIS has also been embraced by the IT community and has become a strategic component of information technologies incorporated into the central systems of many enterprises.

The existing deployments of Esri desktop, server, and mobile GIS technologies in government agencies (notably public health) present many opportunities for shared business capabilities with other human and social services programs. Many state health departments have developed or are currently developing enterprise-wide geocoding services. The state of California's chief information officer recently issued a policy

²⁷ Esri. *HL7 and Spatial Interoperability Standards for Public Health and Health Care Delivery*, January 2011. Retrieved March 2, 2011, from esri.com/library/whitepapers/pdfs/hl7-spatial-interoperability.pdf.

requiring all executive branch agencies to geocode databases or applications related to providing social services, law enforcement, economic development, tax collection, and emergency response. "The new policy simply requires that, where an address exists, latitude and longitude coordinates are to be included as geographic data so they can be compared and analyzed to develop new information sources for state programs."²⁸ An enterprise-wide geocoding service stood up by an agency—for example, the Department of Public Health—could be leveraged by human and social services applications as a shared business capability. Human and social services agencies should also explore the enterprise GIS capacities of their sister agencies, as well as what services they may offer to others. Such enterprise GIS capacities could be leveraged on the application or service level. Updates on various states' GIS initiatives are available from the National States Geographic Information Council (NSGIC) (www.nsgic.org/index.cfm), committed to efficient and effective government through the prudent adoption of geospatial information technologies. For the latest information on states' GIS initiatives, visit www.gisinventory.net.

GIS Software Considerations

Identifying common software needs will make specification, standardization, and implementation of GIS applications for IT modernization more cost-effective and enhance the sharing of data, software, and other resources. Standard capabilities of GIS software and extensions may also be specially configured to support the needs of each human services agency or NGO. This section provides general GIS considerations for software capability needs. The type of software utilized in human and social services IT modernization must be able to do the following:

- **Manage data:** Comprehensive data management and administrative reporting systems will have the ability to examine utilization and expenditure trends. This will be done through various diagnostic and demographic parameters from both an analytic and clinical perspective. In addition, human and social services data routinely collected in the process of enrolling providers and clients will be responsive to GIS data management that allows analysis using additional sources such as demographics and environmental data. Successful uses of data management capabilities depend on adherence to the standard geographic or spatial reference system mentioned earlier. Esri technology meets this requirement fully and provides a comprehensive array of analytic tools for the identification of practice patterns as well as demographically and geographically driven metrics.
- **Use a relational database management system (RDBMS):** Enhanced and more accurate RDBMS-maintained data provides a decision support system of reliable, usable, and accurate data necessary to support an organization's critical business operations such as fraud analysis and detection and federal reporting. An RDBMS provides the following advantages to human and social services organizations:
 - Improved performance, scalability, and portability
 - Improved data integrity
 - Enhanced flexibility and maintainability
 - Enhanced security features

²⁸ California Technology Agency. OCIO Issues Policy to Boost Geographic Mapping Resources for California Government, December 15, 2010. Retrieved March 2, 2011, from www.cio.ca.gov/Public/Newsletters/technology_update121510.html.

Esri technology meets this requirement fully. The geodatabase is the common data storage and management framework for ArcGIS and can be utilized wherever it is needed—on desktops, in servers (including the web), or on mobile devices. ArcGIS implements the geodatabase either as a collection of files in a file system or as a collection of tables within an RDBMS. Table 1 below describes geodatabase types, licensing levels, RDBMS technology, and differentiating characteristics.

Table 1
Geodatabases and RDBMS

Geodatabase	Licensing	RDBMS Technology	Differentiating Characteristics
Enterprise	ArcGIS Server Enterprise	DB2 [®] , Informix [®] , Oracle [®] , SQL Server [®] , PostgreSQL	- Multiuser editing - Support for versioning - Supports spatial types
Workgroup	ArcGIS Server Workgroup	SQL Server Express	- Support for versioning - Maximum of 4 GB of data - 10 concurrent users
Desktop	ArcGIS Desktop ArcGIS Engine	SQL Server Express	- Support for versioning - Maximum of 4 GB of data - 4 concurrent connections
File	ArcInfo [®] , ArcEditor [™] , ArcView [®]	No RDBMS— uses local file structure	- No versioning support - 1 TB per table size limit (default)
Personal	ArcInfo, ArcEditor, ArcView	Microsoft [®] Access [®] (Jet Database Engine)	- No versioning support - Maximum of 2 GB of data

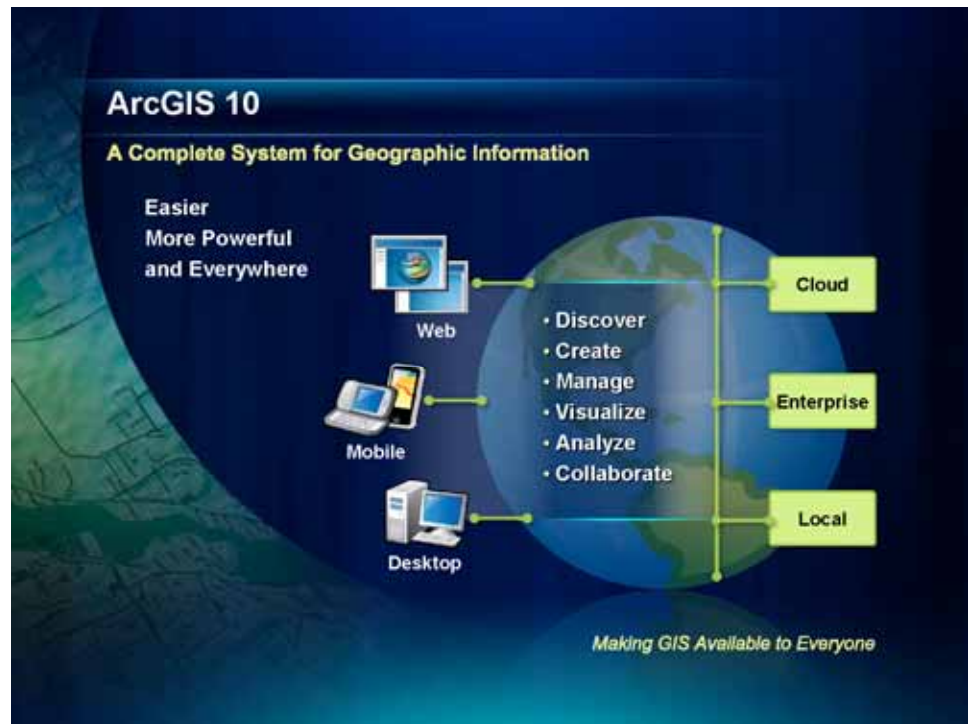
- **Maintain data accuracy:** To ensure that all the mapped information is correctly positioned requires verifying geographic information supplied by clients and providers. This requires stringent address management, ensuring that locations of service are correctly identified and authenticated as well as ascertaining that the client's residential location is accurate. Esri technology supports geocoding in ArcGIS Desktop, and it is also possible to build simple geocoding web applications with ArcGIS Server. Additional solutions include Esri's ArcGISSM Online Services, the ArcGIS Data Appliance, and a number supplied by Esri partners that offer services in address management and geocoding.
- **Perform geographic analysis:** GIS offers a number of geographic analyses. Of particular interest to helping professionals will be the ability to leverage the data routinely collected in the course of enrolling clients and managing cases with previously collected datasets. This is done by combining map layers of different themes to derive new information that describes the relationship between the combined layers. Geostatistical analysis capabilities will also enable helping professionals to apply science to both geography and statistics in the analysis of human and social service issues (e.g., to calculate the probable risks and successes associated with different programs and initiatives). Esri's GIS solutions provide a sound foundation for extensive data integration and analyses in all human and social services databases containing geographic information.

- **Handle map creation and display:** GIS will enable helping professionals to create and display their results in different forms—maps, charts, graphs, and other graphics (such as scatterplots). Maps dynamically linked to charts, graphs, and other graphics allow greater exploratory spatial data analysis. In addition to the capacity of producing maps in traditional paper formats, GIS enables maps to be easily exchanged in digital format on the intranet or Internet or via other storage media. For example, helping professionals may create a series of maps and reports to demonstrate accessibility of services and share it internally via an intranet and with policy makers as printed maps. Esri's GIS solutions meet this requirement fully.
- **Include web functionality:** The web has become a way of sharing and transmitting information. Helping professionals will leverage web functionality to deliver and improve services that seek to lower cost. Solutions must support multiple interfaces in an efficient manner. Esri's GIS solutions meet this requirement fully.
- **Query and display databases:** GIS query tools are frequently used to search for data in the database and display results in both map and tabular formats. The public may also be given access to data that is appropriate for public consumption. Esri's GIS solutions meet this requirement fully and are the foundation for many web-based data query systems developed by HHS agencies.
- **Comply with the Health Insurance Portability and Accountability Act (HIPAA):** HIPAA requires public and private sectors to change processes and information systems to achieve compliance. Section 1171(5)(E) of the Social Security Act, enacted by HIPAA, identifies some programs as health plans that are capable of receiving, processing, and sending standard transactions electronically. Helping professionals may therefore be impacted by HIPAA standards and requirements. Esri's GIS solutions provide the flexibility to meet this requirement.

Esri Solutions to Modernizing Human and Social Services IT

Esri offers a complete range of GIS software and services including software, database design and development, customized applications programming, training, and installation. Esri GIS software packages are the most widely used in the world. Esri GIS solutions are being applied now in health and human services departments across the United States (all 50 state health departments) and around the world. Esri can demonstrate a proven track record of successful GIS technology solutions throughout the HHS sector, from health care organizations to foster care. ArcGIS is a family of complementary products that work together both on the desktop and server (see figure 2). Detailed descriptions of selected Esri products relevant to helping professionals are available in appendix A.

Figure 1
ArcGIS System

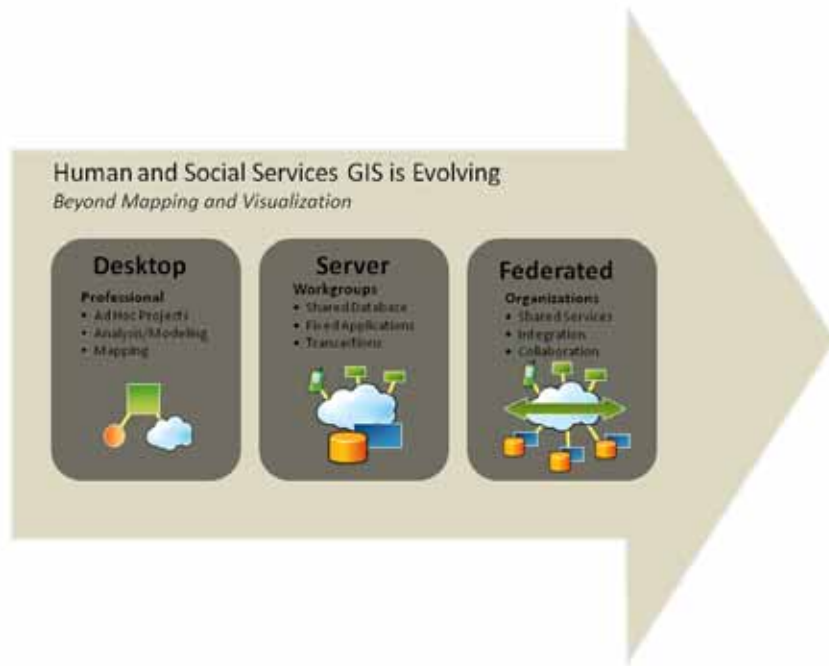


The Future of GIS in Human and Social Services

Esri Interoperability and SOA

Human and social services GIS needs are evolving. The figure below illustrates the evolution from desktop analysis to server-based applications (e.g., resource locators or case management systems). The final stage represents a federated approach, reflecting more GIS collaboration with other agencies and organizations.

Figure 2
Evolution of Human and Social Services GIS



Esri has responded to this fundamental shift in the technology landscape by making ArcGIS service-oriented architecture (SOA) enabled, with full web service integration. This allows customers to readily expose ArcGIS standards-based functionality to other applications and interfaces, thus dramatically improving its value and return on investment.²⁹ With SOA-enabled GIS from Esri, human and social services IT systems can leverage their GIS advances as they progress from desktop analysis to server applications to federated approaches.

Federal agencies in the United States (e.g., Centers for Medicare & Medicaid Services [CMS]) have introduced SOA as an approach to address three major existing challenges for their own information systems. It is anticipated that the SOA approach will spread throughout most human and social services IT systems to overcome those challenges:

- Highly interconnected systems using point-to-point interfaces require pervasive modifications to accommodate changes to business requirements, making them difficult to change.
- Users must navigate through multiple functional systems to perform a single task.
- Systems, to a large extent, are platform dependent and do not communicate easily across functional or technical boundaries, which makes it difficult to share information or reuse functionality.

²⁹ Esri. *Geospatial Service-Oriented Architecture*, June 2007. Retrieved May 29, 2009, from esri.com/library/whitepapers/pdfs/geospatial-soa.pdf.

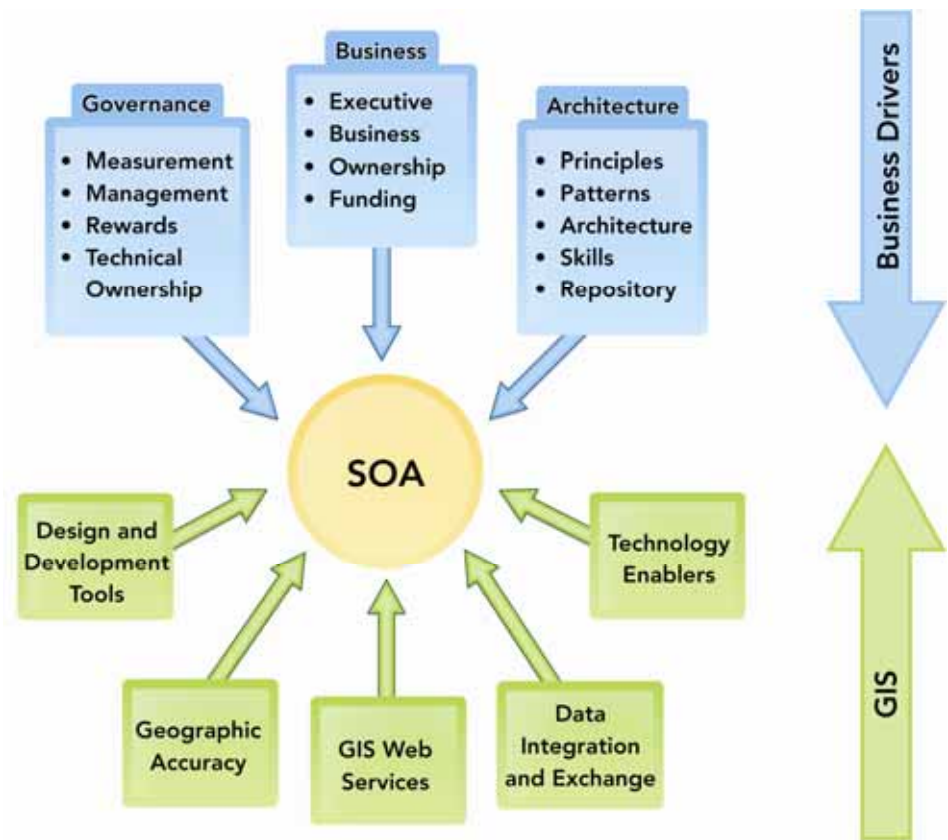
Esri recognizes that data and software capabilities need to be available to a wide range of users in an organization, each of whom may access and use different business tools. The distributed nature of GIS has many implications for interoperability with respect to hardware environments, operating systems, data management, deployment of application logic (desktop, server, mobile, ESB), web services integration, and openly documented application programming interfaces (APIs) and documented XML data schemas. Esri has addressed interoperability comprehensively by implementing a variety of standards, strategies, and techniques in ArcGIS. The chart below briefly summarizes Esri interoperability regarding platforms such as business applications, development, web servers, databases, operating systems, and hardware.

Table 2
Esri Interoperability

Platforms	
Business Application	SAP [®] , Microsoft Office SharePoint [®] , Cognos [®] , IBM [®] Maximo [®] , Primavera, ARCHIBUS, FileNet, CityWorks [®] , Citilabs, EMC Documentum
Development	Microsoft .NET, Java [™] , Adobe [®] Flex [™] , Microsoft Virtual Earth [®] , Google Earth [™]
Web Server	Apache [™] , Apache Tomcat [™] , JBoss, Microsoft IIS, WebSphere [®] , Oracle [®] WebLogic, Oracle Application Server
Database	Microsoft SQL Server, Oracle, IBM DB2 Informix, PostgreSQL
Operating System	Linux [®] , Solaris [™] , Windows [®]
Hardware	Intel [®] , AMD [®] , Sun [™] , HP [®] , IBM

Esri is also positioned to assist human and social services organizations and their systems integrators as they pursue planning and development. In addition to products, Esri offers many resources to facilitate the governance, business, and architecture of SOA deployment. Esri's Professional Services Division includes health and human services domain specialists, and its partner program includes both organizations that have developed SOA connectors and those with domain specialty in human and social services. Figure 3 summarizes how Esri can facilitate SOA deployment.

Figure 3
How Esri Can Facilitate SOA Deployment



The Cloud

It is likely that more and more human services organizations will rely on cloud applications for a range of business purposes. For users of GIS technology, the cloud opens a number of new possibilities. The advantages of using the cloud for applications include easier and faster deployment, lower cost, better performance, and simpler development and testing.³⁰ An example of this type of cloud deployment is the U.S. Department of Agriculture's (USDA) Supplemental Nutrition Assistance Program (SNAP) Retail Locator, which helps individuals locate the nearest business that accepts the SNAP Card.³¹ USDA built this rich retail locator with assistance from Esri; the application is hosted on Amazon Web Services.

Research and Development Projects

The complexities of human and social services programs present many interesting opportunities for day-to-day business process improvement. The consistent stream of new data, combined with historical data, also provides a basis for continued spatial analysis research and development. GIS and GPS will continue to provide new opportunities to helping professionals, but there are many unanswered questions regarding best approaches and applicability. Esri has an extensive user community in health and human

³⁰ Chappell, David. *GIS in the Cloud: The Esri Example*, September 2010, esri.com/library/whitepapers/pdfs/gis-in-the-cloud-chappell.pdf.

³¹ See aws.typepad.com/aws/2010/10/cloud-computing-and-the-world-of-geoapps.html.

services (the Health User Group, or HUG). Many HUG members based in universities and research organizations are interested in partnering with entities such as human and social services agencies for spatial analysis research and development projects. In addition, Esri has a history of partnering with organizations to collaborate on cutting-edge implementations.

How to Get Started

Human and Social Services Agencies

Esri's health team includes domain specialists who are prepared to have discussions with staff from human and social services agencies regarding how GIS can support their programmatic goals. Leadership and staff of human and social services agencies should also consider the following resources:

- Visit the Esri [GIS and Human Services](#) web pages.
- Contact healthinfo@esri.com.
- Subscribe to [HealthyGIS](#), a quarterly newsletter about software, events, and user stories affecting the health and human services GIS community.
- Join the [Esri Health & Human Services User Group](#), an active community of over 1,000 professionals dedicated to sharing information, ideas, and experiences about Esri technology in the health and human services industry.
- Order [GIS Tutorial for Health](#) and other titles from [Esri Press](#).
- Attend the [Esri Health GIS Conference](#) or [Esri International User Conference](#).
- View health presentations from [past Esri conferences](#).
- Take a class through the [Esri Virtual Campus](#).
- Learn more about [Esri Professional Services](#).
- View ArcGIS Server [live user sites](#).
- Learn more about [ArcGIS Mapping for SharePoint](#).
- Download Esri white papers:
 - [Geographic Information Systems and Medicaid Modernization: Incorporating Esri Technology and Services](#)
 - [HL7 and Spatial Interoperability Standards for Public Health and Health Care Delivery](#)
 - [Geospatial Service-Oriented Architecture \(SOA\)](#)

- [Developing and Deploying an Integrated Geoenabled SOA Business Solution: A Case Study](#)
- [Esri-Supported Open Geospatial Consortium, Inc., and ISO/TC 211 Standards](#)
- [System Design Strategies](#)

Another resource is the Esri Partner Network, which has over 2,000 partners providing best-in-class GIS solutions. Esri partners have built expertise in specific areas such as

- Web portals
- Data warehouses
- Fraud detection
- Data mining
- Integration kits with business intelligence/dashboard solutions
- Human services, social services, and other HHS domain expertise (e.g., needs assessment, application development)

Systems Integrators and Developers

As indicated in appendix A of this paper, Esri has an extensive array of software products and professional and technical services that can assist any prime contractor in fulfilling all GIS-related requirements of human and social services IT system requests for proposal (RFPs). Esri is prepared to provide all necessary documentation, including assigned staff and their resumés, as well as reference sites, required by an RFP to address all GIS-related requirements and provide specific pricing for both software and professional services. Contact Esri Professional Services for further information or assistance at esri.com.

In addition to the white papers, demos, and other resources described above for staff of human and social services agencies, systems integrators and developers should also consider the following:

- Join the [Esri Developer Network](#) (EDNSM), a cost-effective way to use and leverage ArcGIS products and technologies in applications and systems they design and build.
- Attend the [Esri Developer Summit](#), an opportunity to connect with Esri staff and software developers from around the world to explore trends, tips, and best practices for effective GIS development.

Esri Nonprofit Program

In 2010, Esri launched a new nonprofit program. It is designed to provide conservation and humanitarian nonprofit organizations around the world with an affordable means of acquiring ArcGIS software and services for organized volunteer efforts. Human service nonprofit organizations may also be eligible for membership in the program. Eligibility is based on the organization's formal tax-exempt status and the type of work it does. Visit esri.com/nonprofit/ for more information.

Appendix A: Esri Solutions to Modernizing Human and Social Services IT

ArcView ArcView is a powerful tool for the management, display, query, and analysis of spatial information. ArcView software's extensible architecture has enabled Esri to develop optional plug-in modules, dramatically extending the software's functional capabilities (e.g., OLAP for ArcGIS, a free add-on that allows users of online analytic processing [OLAP] server technology to view their business data in the ArcGIS environment via read-only tables). ArcView links traditional data analysis tools, such as spreadsheets, databases, and business graphics, with maps for a completely integrated analysis system. By integrating an organization's data geographically, new patterns can be uncovered and new insights gained. Several recent developments relevant to human and social services include

- Improved support for PDF documents (For example, users can author a map document and export it in PDF for wide distribution while passing along the ability for increased end-user interaction with the document beyond simple viewing.)
- A model-building tool that facilitates iterative modeling capabilities
- Linked maps, graphs, charts, and scatterplots so users can perform exploratory spatial data analysis (ESDA)
- A significant spatial statistics toolbox featuring tools for spatial autocorrelation, analyzing spatial patterns (i.e., clustering or dispersion), and assessing spatial distributions

ArcGIS Server ArcGIS Server connects people with geographic information via web applications and services. Organizations use ArcGIS Server to distribute maps and GIS capabilities over the web to improve internal workflows, communicate vital issues, and engage stakeholders. By providing key technologies and supporting interoperability with standards such as .NET 2.0; Enterprise JavaBeans™; Web Services Interoperability Organization (WS-I)-compliant web services; and Open Geospatial Consortium, Inc.® (OGC®), services out of the box, the ArcGIS Server technology platform is ideally suited to SOA deployment in Medicaid Information Technology Architecture (MITA). With ArcGIS Server, human and social services organizations can

- Improve decisions and productivity with web mapping services and applications that can be delivered to web, desktop, and mobile workforces.

- Leverage existing IT architecture by integrating a GIS server and spatial data with other enterprise systems, such as customer relationship management (CRM) or enterprise resource planning (ERP) systems.
- Rapidly meet specialized demand for focused applications by mashing up geographic content with GIS functionality.
- Take control of spatial data through centralized management of data, applications, and services.
- Provide fast access to large volumes of imagery using image services, with the option for dynamic mosaicking, on-the-fly processing, and reduction of storage costs and data processing overhead.

ArcPad

ArcPad® is for field mapping and data collection. Human and social services organizations can use ArcPad to

- Perform reliable, accurate, and validated field data collection.
- Integrate GPS and digital cameras into GIS data collection.
- Share enterprise data with field-workers for updating and decision making.

ArcGIS Spatial Analyst

ArcGIS Spatial Analyst brings sophisticated raster and vector data analysis to the desktop. It seamlessly integrates raster-based spatial analysis with ArcView software's vector-based mapping and analysis. This powerful combination brings unprecedented power for mapping, visualization, modeling, and analysis to human services organizations in an affordable desktop package. Spatial Analyst provides the tools needed to support a broad range of spatial modeling and application requirements. With Spatial Analyst, a human or social services organization can perform capability, sensitivity, predictive, and site suitability modeling; site location analysis; demographic analysis; and much more.

ArcGIS Network Analyst

ArcGIS Network Analyst is a powerful extension that provides network-based spatial analysis including routing, travel directions, and closest facility and service area analysis. Network Analyst enables users to dynamically model realistic network conditions, including turn restrictions, speed limits, height restrictions, and traffic conditions, at different times of the day. With Network Analyst, human and social services organizations can conduct

- Drive-time analysis
- Point-to-point routing
- Route directions
- Service area definition
- Network analysis
 - Shortest path
 - Optimum route
 - Closest facility
 - Origin-destination

ArcLogistics

ArcLogistics™ is a complete desktop solution for creating optimized routes and solving scheduling problems. Create dynamic routes and schedules that cut fuel costs and improve customer service using ArcLogistics. From a small fleet operation to a large multiuser environment, ArcLogistics provides a quick and significant return on investment. With ArcLogistics, human and social services organizations will

- Create routes and schedules in less time.
- Meet commitments and improve service.
- Save money, use less fuel, and reduce emissions.

Business Analyst and Business Analyst Server

Esri Business Analyst™ combines Esri's leading GIS technology with extensive business, demographic, and consumer data. By combining information such as sales data, demographics, and competitor locations with census boundaries, territories, and store locations, Business Analyst helps human services agencies better understand their market and their clients. Business Analyst is available with U.S. or Canadian data. With Business Analyst, human and social services organizations will

- Choose the ideal location to offer programs and services.
- Target underserved markets.
- Perform site and trade area analysis.
- Customize and automate frequently used analyses.
- Develop and share reports with demographic, consumer, and business data or their own human and social services data.
- Discover cross-marketing opportunities.
- Build interactive forecast and market share models based on the Huff model.

For a complete enterprise solution, the desktop version of Business Analyst may be combined with Business Analyst Server.

Esri Data

Esri's business, consumer spending, and demographic data encompasses a wide variety of datasets that help agencies, companies, and organizations analyze markets, profile customers, evaluate competitors, and more. Esri data is available as part of Business Analyst, Business Analyst Server, or Business Analyst OnlineSM or as individual databases. Human and social services organizations can use Esri data to

- Analyze and describe a community or service area.
- Identify new sites for facilities or programs.
- Evaluate competitor sites.
- Profile customers and constituents.
- Forecast demand for products and services.

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Developer Tools

Esri also offers a number of developer tools such as

- ArcGIS Web Mapping APIs—ArcGIS API for Flex, JavaScript™, and Silverlight®
- Mobile APIs—ArcGIS API for iOS™, Windows Phone, and Android™
- Tools for Java
- Tools for .NET
- Esri Developer Network
- ArcGIS Engine

For a full list of Esri products, visit esri.com/product-list.

Appendix B: Key Terms and Acronyms

ACF: Administration for Children and Families (a division of the Department of Health and Human Services in the United States)

AoA: Administration on Aging (a division of the Department of Health and Human Services in the United States)

Automation (computing): The automatic functioning of a machine, system, or process without the need for human interaction.

Automation (software): In COM technology, a feature that allows an object that was designed for use in one application to be accessed in another application (For example, ArcObjects may be accessed in Visual Basic and in other languages, tools, and applications that support automation.)

Client: An application, computer, or device in a client/server model that makes requests to a server (Although client/server architecture can exist on one computer, it is more relevant to network systems that distribute applications over computers to different locations.)

CMS: Centers for Medicare & Medicaid Services (a division of the Department of Health and Human Services in the United States)

Enterprise GIS: A geographic information system that is integrated through an entire organization so that a large number of users can manage, share, and use spatial data and related information to address a variety of needs, including data creation, modification, visualization, analysis, and dissemination

Feature: The representation of a geographic feature that has both a spatial representation (referred to as a shape) and a set of attributes (Features can be represented as points, lines, polygons, or grids.)

Geocode: A code representing the location of an object, such as an address; a census tract; a postal code; or x,y coordinates

Geocoding: A GIS operation for converting street addresses into spatial data that can be displayed as features on a map, usually by referencing address information from a street segment data layer

Geodatabase: A collection of geographic datasets for use by ArcGIS (There are various types of geographic datasets including feature classes, attribute tables, raster datasets, network datasets, and topologies.)

Geographic information system (GIS): An integrated collection of computer software and data used to view and manage information connected with specific locations, analyze

spatial relationships, and model spatial processes (For an informative presentation, visit esri.com/what-is-gis.)

GPS: Global Positioning System, a system of radio-emitting and -receiving satellites used for determining positions on the earth (The orbiting satellites transmit signals that allow a GPS receiver anywhere on earth to calculate its own location through trilateration. Developed and operated by the U.S. Department of Defense, the system is used in navigation, mapping, surveying, and other applications in which precise positioning is necessary.)

HCBS: Home and community-based services

Health Insurance Portability and Accountability Act of 1996 (HIPAA): Public Law 104-191, which resulted in new privacy standards for health information in the United States (HIPAA's goals include improving portability and continuity of health insurance coverage in the group and individual markets; combating waste, fraud, and abuse in health insurance and health care delivery; and simplifying the administration of health insurance, among other purposes.³² HIPAA has impacted how providers communicate electronically with human services and other programs.)

Health Level 7 (HL7): One of several American National Standards Institute (ANSI)-accredited standards developing organizations (SDOs) operating in the health care arena (HL7 produces standards [sometimes called *specifications* or *protocols*] for the particular health care domain of clinical and administrative data.³³)

HHS: Health and human services; can also denote Department of Health and Human Services (United States)

Human services: Meeting human needs through an interdisciplinary knowledge base, focusing on prevention as well as remediation of problems, and maintaining a commitment to improving the overall quality of life of populations³⁴

Interoperability: The capability of components or systems to exchange data with other components or systems or to perform in multiple environments

Medicaid: A federal entitlement program in the United States that provides free or low-cost health and long-term care coverage to certain categories of low-income Americans (States design their own Medicaid programs within broad federal guidelines.³⁵)

Medicaid Information Technology Architecture (MITA): A CMS IT initiative to transform the concept of today's state-based claims processing systems into an

³² United States Congress. Health Insurance Portability and Accountability Act of 1996. Retrieved May 26, 2009, from www.cms.hhs.gov/HIPAAGenInfo/Downloads/HIPAALaw.pdf.

³³ Health Level Seven. *What is HL7?* Retrieved May 26, 2009, from www.hl7.org/.

³⁴ National Association of Human Services. "The Human Service Worker." Retrieved May 14, 2009, from http://www.nationalhumanservices.org/index.php?option=com_content&view=article&id=88&Itemid=89.

³⁵ Kaiser Family Foundation. 2007. *Medicaid: A Primer*. Retrieved May 26, 2009, from www.kff.org/medicaid/7334-02.cfm.

enterprise-wide backbone architecture capable of addressing tomorrow's Medicaid needs, as well as today's³⁶

Medicaid Management Information System (MMIS): An integrated group of procedures and computer processing operations (subsystems) developed at the general design level to meet principal objectives (The objectives of this system and its enhancements include the Title XIX program control and administrative costs; service to recipients, providers, and inquiries; operations of claims control and computer capabilities; and management reporting for planning and control.³⁷)

Raster: A spatial data model that defines space as an array of equally sized cells arranged in rows and columns and composed of single or multiple bands (Each cell contains an attribute value and location coordinates. Unlike a vector structure, which stores coordinates explicitly, raster coordinates are contained in the ordering of the matrix. Groups of cells that share the same value represent the same type of geographic feature.)

Reference Information Model (RIM): An object model created as part of the HL7 Version 3 methodology (The RIM is a large pictorial representation of the clinical data [domains] and identifies the life cycle of events that a message or groups of related messages will carry. It is a shared model between all the domains and as such is the model from which all domains create their messages. Explicitly representing the connections that exist between the information carried in the fields of HL7 messages, the RIM is essential to HL7's ongoing mission of increasing precision and reducing implementation costs.³⁸)

SAMHSA: Substance Abuse and Mental Health Services Administration (a division of the U.S. Department of Health and Human Services)

Server: A computer that manages shared resources, such as disks, printers, and databases, on a network; software that provides services or functionality to client software (For example, a web server is software that sends web pages to browsers.)

Service-oriented architecture (SOA): An architecture in which core business capabilities are encapsulated within independent software services leveraged by various front-end applications to fulfill business requirements³⁹

Social work: A profession that promotes social change, problem solving in human relationships, and the empowerment and liberation of people to enhance well-being

³⁶ Friedman, Rick. April 18, 2006. MITA: A Vision of Evolving Medicaid Systems. Presentation from Collaborative Expedition Workshop at the National Science Foundation, Arlington, VA. Retrieved May 26, 2009, from colab.cim3.net/file/work/Expedition_Workshop/2006-04-18_OpenCollaboration_NetworkingHealthIT/Friedman_CMS_and_MITA_2006_04_18.ppt.

³⁷ Centers for Medicare & Medicaid Services. Overview of the Medicaid Management Information System. Retrieved May 26, 2009, from www.cms.hhs.gov/MMIS/.

³⁸ Health Level Seven. *The Reference Information Model (RIM)*. Retrieved May 26, 2009, from www.hl7.org/.

³⁹ Kawamoto, Kensaku, and David Lobach. "Proposal for Fulfilling Strategic Objectives of the U.S. Roadmap for National Action on Decision Support through a Service-Oriented Architecture Leveraging HL7 Services," *Journal of the American Medical Information Association* (2007): 146–155.

(Utilizing theories of human behavior and social systems, social work intervenes at the points where people interact with their environments.⁴⁰)

Spatial modeling: Analytic procedures applied with GIS (There are three categories of spatial modeling functions that can be applied to geographic features within a GIS: geometric models, such as calculating the Euclidean distance between features, generating buffers, and calculating areas and perimeters; coincidence models such as topological overlay; and adjacency models such as pathfinding, redistricting, and allocation. All three model categories support operations on spatial data such as points, lines, polygons, and grids.)

TANF: Temporary Assistance for Needy Families, a bureau of ACF in the United States with primary responsibility for the administration of the programs authorized under titles IV-A and XVI of the Social Security Act (The TANF Bureau provides assistance and work opportunities to needy families by granting states, territories, and tribes the federal funds and wide flexibility to develop and implement their own welfare programs. The assistance is time limited and promotes work, responsibility, and self-sufficiency.⁴¹)

Vector: A coordinate-based data model that represents geographic features as points, lines, and polygons (Each point feature is represented as a single coordinate pair, while line and polygon features are represented as ordered lists of vertices. Attributes are associated with each vector feature, as opposed to a raster data model, which associates attributes with grid cells.)

Web service: A software component accessible over the web for use in other applications (Web services are built using industry standards, such as XML and SOAP, and thus are not dependent on any particular operating system or programming language, allowing access to them through a wide range of applications.)

WIC: Women, Infants, and Children, a program of the United States Department of Agriculture's Food and Nutrition Service (WIC provides federal grants to states for supplemental foods, health care referrals, and nutrition education for low-income pregnant, breastfeeding, and non-breastfeeding postpartum women and to infants and children up to age five who are found to be at nutritional risk.⁴²)

⁴⁰ International Federation of Social Workers. Definition of Social Work. Retrieved May 26, 2009, from www.ifsw.org/f38000138.html.

⁴¹ U.S. Department of Health & Human Services. About TANF. Retrieved May 26, 2009, from www.acf.hhs.gov/programs/ofa/tanf/about.html.

⁴² United States Department of Agriculture. Women, Infants, and Children. Retrieved May 26, 2009, from www.fns.usda.gov/wic/.



About Esri

Since 1969, Esri has been helping organizations map and model our world. Esri's GIS software tools and methodologies enable these organizations to effectively analyze and manage their geographic information and make better decisions. They are supported by our experienced and knowledgeable staff and extensive network of business partners and international distributors.

A full-service GIS company, Esri supports the implementation of GIS technology on desktops, servers, online services, and mobile devices. These GIS solutions are flexible, customizable, and easy to use.

Our Focus

Esri software is used by hundreds of thousands of organizations that apply GIS to solve problems and make our world a better place to live. We pay close attention to our users to ensure they have the best tools possible to accomplish their missions. A comprehensive suite of training options offered worldwide helps our users fully leverage their GIS applications.

Esri is a socially conscious business, actively supporting organizations involved in education, conservation, sustainable development, and humanitarian affairs.

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